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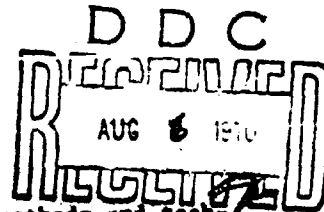
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25 June 1970

Material Test Procedure 9-3-302
General Equipment Test Activity

U. S. ARMY TEST AND EVALUATION COMMAND
COMMODITY SERVICE TEST PROCEDURE

PIPELINE CLEANING EQUIPMENT



1. OBJECTIVE*

The objective of this document is to provide test methods and techniques necessary to determine the degree to which pipeline cleaning equipment and their associated tools and equipment perform their missions as described in Qualitative Materiel Requirements (QMR's), Small Development Requirements (SDR's), and the suitability of these items and their maintenance packages for use by the Army.

2. BACKGROUND

Today's highly mechanized Army requires adequate supplies of petroleum, oils, and lubricants (POL) for a variety of uses on land, in the sea and air. Approved military requirements currently exist for the protection against contamination of POL used by the Army for tactical and support missions.

Presently there are a variety of pipeline cleaning methods employed to ensure cleanliness of the POL used for the U. S. Army. These are:

a. Filter-Installed usually on the downstream side of the loading pump, in supply lines between storage tanks and tank car and tank vehicle loading racks, in transporters for transfers to other vehicles and refuelers for the removal of solid contamination consisting of both suspended particles and sediment.

b. Filter/Separator-Installed usually on the downstream side of the loading pump, in supply lines between storage tanks and tank car or tank vehicle loading racks, in transporters, tank vehicles and refuelers used to remove free water and fine solid contaminants from the POL. Fuels for aircraft and for ground equipment as sensitive to contamination as M-60 tanks must be transferred and dispensed through filter/separators.

c. Water Separator-Installed in military pipelines as a component of fuel system supply point for receipts from tank cars, transporters, or pipelines; and for deliveries to tank vehicles and others to remove free water from the POL. Every reasonable effort should be made to prevent delivery of free water, especially salt water, to any tank thereby protecting against corrosion and contamination.

d. Sand Traps-Installed in military pipelines usually on the suction side of the pump station manifold parallel to the mainline to remove the dirt, sludge, scale and floating debris from the POL.

e. Strainers-Installed usually in the suction line to pumps, inlet side of meters, filters, filter/separators and on the fill line to underground storage tanks. A line or sediment strainer is a metal shell, or chamber, that

*This MTP is intended to be used as a basic guide in preparing actual test plans for the subject equipment. Specific criteria and test procedures must be determined only after careful appraisal of pertinent QMR's, SDR's, TC's, and any other applicable documents.

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- A. Army Regulation 70-38, Test and Evaluation of Materiel for Extreme Climatic Conditions.
- B. AMCP 706-134, Engineering Design Handbook, Maintainability Guide for Design.
- C. USATECOM Regulation 385-6, Verification of Safety of Materiel During Testing.
- D. USATECOM Regulation 700-1, Value Analysis.
- E. USATECOM Regulation 70-23, Equipment Performance Report (EPR's).
- F. USARHEL Standard S-1-63, Maximum Noise Level for Army Materiel Command Equipment.
- G. USAGETA Document, Human Factors Evaluation Data for General Equipment (HEDGE).
- H. MIL-C-3774, Crates, Wood, Open, 12000-AND-16000.
- I. MIL-H-15424, Hand Tools, Packaging of.
- J. MIL-P-116, Preservation, Methods of.
- K. MIL-T-704, Treatment and Painting of Materiel.
- L. MIL-W-52574, Welding and Welding Procedure Requirements for Manufacture of Equipment Utilizing Steels.
- M. MIL-STD-129, Marking for Shipment and Storage.
- N. MIL-STD-130, Identification Marking of US Military Property.
- O. MIL-STD-209, Slings, Eyes and Attachments for Lifting and Tying Down Military Equipment.

STATEMENT #2 UNCLASSIFIED

This document is subject to special export controls and each transmittal to foreign governments or foreign nationals may be made only with prior approval of U.S. State Dept.

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- P. MIL-STD-794, Parts and Equipment. Procedures for Packaging and Packing of.
- Q. MTP 2-3-519, Surface Transportability (Vehicles).
- R. MTP 7-3-515, Air Portability. Internal - Suitability of Supplies and Equipment for.
- S. MTP 9-3-503, Reliability.
- T. MTP 10-3-500, Pre-Operation of Inspection and Physical Characteristics.
- U. MTP 10-3-501, Operator Training and Familiarization.
- V. MTP 10-3-503, Transportability (General Supplies and Equipment).
- W. MTP 10-3-504, Maintenance Evaluation.
- X. MTP 10-3-505, Human Factors Engineering.
- Y. MTP 10-3-507, Safety Hazards.
- Z. MTP 10-3-510, Logistics-Over-the-Shore (LOTS) (General Equipment and Supplies).
- AA. MTP 10-3-511, Quality Assurance.
- AB. MTP 10-3-512, Reliability.

5. SCOPE

5.1 SUMMARY

This document describes the preparation for and methods of evaluating the mission oriented performance of pipeline cleaning equipment while being utilized by Army personnel under service use conditions. The evaluations required are summarized as follows:

- a. Preparation for Test - A determination of the condition and physical characteristics of the test item upon arrival, an inspection to ensure that the test item is complete and functionally operational and an operator training and familiarization program.
- b. Operational Performance - An evaluation to determine ability of the test item to perform its intended mission when utilized by service personnel under TOE conditions.
- c. Transportability - An evaluation to determine ability of test item to be prepared for transport and to be transported by service personnel.
- d. Maintenance - An evaluation to determine and appraise the test item's maintenance characteristics and requirements, a verification and appraisal of its malfunctions, an evaluation of the test item's associated publications and other common and special support elements (maintenance test package), an appraisal of the test item's design for maintainability (AMCP 706-134: accessibility, ease of maintenance, standardization, and interchangeability), an evaluation of component and system durability and reliability, and the calculation of indicators which express the effects of appropriate preceding aspects.
- e. Safety - An evaluation to determine the test item compliance with safety requirements and to confirm the test item's safety characteristics during conduct of all tests.
- f. Human Factors Evaluation - An evaluation to determine the adequacy of the design and performance characteristics of the test item and associated equipment in terms of compatibility with the capabilities and limitations of specified user personnel with the test item under the environmental and operational conditions for which it was designed. Characteristics of the test item

as related to human factors and revealed during the conduct of each test shall be examined.

g. Value Analysis - An evaluation directed at analyzing the primary functions and features of the test item for the purpose of reducing the cost of the test item without compromising the desired performance and safety characteristics.

h. Quality Assurance - A study to determine the quality of the test item.

5.2 LIMITATIONS

None.

6. PROCEDURES

6.1 PREPARATION FOR TEST

6.1.1 Initial Inspection

a. Examine the shipping method, preservation and packaging and determine any nonconformance with the following:

- 1) Wooden Crates (MIL-C-3774).
- 2) Procedures for packaging and packing of data and equipment (MIL-STD-794).
- 3) General preservation requirements (MIL-P-116).
- 4) Container markings (MIL-STD-129).
- 5) Packaging of provided hand tools (MIL-H-15424).

b. Record the following:

- 1) Evidence of damage or deterioration to packaging or shipping components and materials.
- 2) All identification markings.

c. Remove the test item from its shipping carrier, if applicable, and record the following:

- 1) All printed material accompanying the test item and agreement with test item markings.
- 2) Equipment, time and personnel required to uncrate and assemble the test item.
- 3) Comments regarding the method and materials used to secure the test item.

6.1.1.1 Test Item Inspection

The test item will be marked in accordance with MIL-STD-130 and in addition the test item will be visually inspected for evidence of defects, damage and wear in its manufacturing, materials and workmanship. In particular,

the following will be considered:

- a. Certify that the specified test item to be evaluated meets the minimum requirements for hydrostatic testing.
- b. Metal surfaces will be treated for rust and/or painted in accordance with MIL-T-704.
- c. Welding will be free from cracks, slag, pitholes, porosity, fractures, and have a smooth, clean appearance.
- d. Insure that all synthetic materials used in the fabrication of test item assemblies are resistant to aromatic gasoline and POL in general to provide sufficient flexibility at low fuel temperatures to permit satisfactory operation.
- e. Hardware should be of sufficient size and strength to safely withstand maximum operating pressures and be tightly drawn.
- f. Check the test item's interior surface for smoothness, freedom from protrusions, sharp edges and weld slag or flux weld projections protruding from the surface.
- g. Check the test item for flow direction indication.

6.1.2 Inventory Check

a. Conduct an inventory against the Basic Issue Items List (BILL). Record evidence of the following:

- 1) Missing maintenance literature or draft technical manuals
- 2) Shortages in repair parts, accessories, or tools
- 3) Missing kits

b. Submit an Equipment Performance Report (EPR) for each noted shortage or discrepancy in accordance with applicable procedures in USATECOM Regulation 70-23.

6.1.3 Physical Characteristics

The physical characteristics of the test item shall be determined by performing the applicable sections of MTP 10-3-500.

6.1.4 Operator Training and Familiarization

Test personnel should undergo the applicable procedures of MTP 10-3-501.

6.1.5 Pre-Operational Checks

Perform the following:

- a. Depreservation and assembly - remove all preservation for the test item and attach any hardware that was removed from the test item for transporting convenience. Record all depreservation and assembly procedures required and the adequacy of the specified technical manual instructions for these procedures.
- b. Cleaning elements - verify the screens, filter elements, water

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separator elements are new, clean and properly installed.

c. Hardware - ensure that each test item assembly is firmly attached to the proposed POL system and all compounds or subassemblies are fastened and ready for operation.

d. Leakage - ensure that the installed test item(s) does not permit leakage of POL when under operating pressure and flow.

6.2 TEST CONDUCT

NOTE: All equipment malfunctions shall be reported in accordance with USATECOM Regulation 70-23.

6.2.1 Operational Performance

The operational performance of the test item will be determined by placing the test item in extended service in actual mission-type assignments under TOE environments. Authorized MOS-qualified personnel will operate and maintain the test item using appropriate products, tools and equipment. The length of the operational period will be planned using designated unit mission time and will include sustained mission operations and provisions for scheduled maintenance and allowable downtime. Suitability of the test item for task operations and conformance with the specified QMR or SDR requirements will be determined by conducting or simulating the various mission tasks listed, but not limited to those below:

- a. Marine terminal - transfer and storage.
- b. Base terminal - transfer and storage.
- c. Intermediate and pipehead terminal - transfer and storage.
- d. Dispensing installation, terminal loading and unloading - transfer and storage.
- e. The test item will be tested in the normal authorized pipeline communications network for the full spectrum of POL pipeline usages under intermediate environmental conditions using the following fluids:

- 1) Gasoline
- 2) Kerosene
- 3) Oils (light)
- 4) Oils (heavy)
- 5) Fluid lubricants, if applicable

6.2.2 Environmental Tests

Appropriate environmental tests will be performed on the test item in accordance with the expected use environment in which the test item will be operated.

6.2.2.1 General

- a. Perform specified POL bulk supply and distribution operation(s) under environmental conditions within the limits specified by AR 70-38 for intermediate climate conditions in accordance with guidance of 6.2.1. Record

specific details of test item performance of each operation, include, but do not limit to the data requirements outlined below:

- 1) Type, name, and grade at POL
- 2) POL Effluent Sampling data
 - a) Total water content
 - b) Total solid content
 - c) Interfacial surface tension value
 - d) Water separator index
 - e) Specific gravity
 - f) Viscosity
- 3) Fluid flow
- 4) Test item differential pressure, if applicable
- 5) POL temperature
- 6) Meteorological conditions

b. Evaluate and rate the adequacy of the test item in terms of compatibility with the various POL's and the pipeline equipment and facilities. Record the following:

- 1) Evidence that the test item is capable of maintaining the required cleaning performance when subjected to the various listed test fluids.
- 2) Comments on the ease of installation and removal of the test item from the pipeline installation.
- 3) Evidence of abnormal operational efficiency produced as a result of test item(s) abnormality or failure(s).
- 4) Adverse POL pipeline system operational effects during storage or transfer of POL's under dynamic and static conditions.
- 5) Indications that cleaning equipment, cleaning methods and techniques when in operation with the pipeline system, was dangerous or otherwise unsuitable.

c. Evaluate the efficiency of the test item and the operating time. Record the following:

- 1) Degradation of water removal as a function of operation time.
- 2) Degradation of solids removed as a function of operation time.
- 3) Any increase of pipeline pressure.
- 4) Any reduction of pipeline fluid flow or increased pump motor power required to maintain normal rated flow.
- 5) Excessive pressure drop across test item as a function of operation time.

6.2.2.2 Climatic Extremes

When required, evaluate test item capability to meet operation

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objectives under the stresses imposed by climatic extremes identified by AA 70-38.

6.2.2.2.1 Hot-Dry Climatic Conditions Test - Conduct 6.2.1 under desert operational conditions. Record the data required by subtests of 6.2.1 and the following:

- a. Overall effect of desert conditions on test item performance.
- b. Overall effect of desert conditions on test item compatibility.
- c. Any noted test item characteristics or malfunctions which occurred as a direct result of desert usage.

6.2.2.2.2 Warm-Wet Climatic Conditions Test - Conduct 6.2.1 under tropic environmental conditions. Record the data required by subtests of 6.2.1 and the following:

- a. Overall effect of tropic conditions on test compatibility.
- b. Overall effect of tropic conditions on test item performance.
- c. Any noted test item characteristics or malfunctions which occurred as a direct result of tropic usage.

6.2.2.2.3 Cold Climatic Conditions Test - Conduct 6.2.1 under arctic environmental conditions. Record the data required by subtests at 6.2.1 and the following:

- a. Overall effect of arctic conditions on test item compatibility.
- b. Overall effect of arctic conditions on test item performance.
- c. Any noted test item characteristic or malfunction which occurred as a direct result of arctic usage.

6.2.3 Transportability

Examine transportability characteristics of the test item as revealed during the preparation for and during the actual conduct of transporting operations. Conduct the evaluation in accordance with MTP 10-3-503. Review the draft technical manual for procedures related to tying down, lifting and transporting by various media and report any inadequacy of instructions by EPR. For each phase of the evaluation, determine and record the following:

- a. Procedures, materials, and tools utilized
- b. Time required
- c. Personnel required
- d. Adequacy of instructions in draft technical manual
- e. Difficulties experienced and suggestions for improvements

6.2.3.1 Preparation for Transport

- a. Perform any disassembly, locking or removal operations required.
- b. Mount, package, mark or enclose the test item using instructions in the draft technical manual employing material, equipment, and tools indigenous to user organization.

c. Evaluate and record the effectiveness of tie downs, securing devices, lifting attachments, and slinging eyes according to MIL-STD-209, as applicable.

6.2.3.2 Load/Unload

Using authorized equipment and materiel handling techniques move the packaged test item to the carrier and into or onto the carrier. Examine and record the effectiveness of the operation and compatibility with the materiel handling equipment used.

6.2.3.3 Transporting Modes

Conduct the following subtests to the extent applicable:

- a. Surface transportability in accordance with the requirements of MTP 10-3-503.
- b. Air transportability in accordance with the requirements of MTP 7-3-515.
- c. Logistics-Over-the-Shore (LOTS) in accordance with MTP 10-3-510.

At the completion of each of the transportability subtests, examine the test item, its packaging, and mounting for damage or other undesirable effects (such as shifting). Record the findings of this inspection.

6.2.4 Maintenance

Evaluate the maintenance-related factors of the test item as described in MTP 10-3-504 and MTP 10-3-512 with emphasis on the following:

a. Organizational (O), Direct Support (F), and General Support (H) Maintenance requirements. Perform, on the test item and ancillary equipment, all authorized organizational maintenance functions listed on the maintenance allocation chart. Allocate sufficient time during the period of the test for maintenance personnel to perform such functions.

- 1) Verify that the maintenance allocation chart is adequate and complete in describing the test item maintenance program, and that only common tools, skills, and time expected to be available are used to perform the tasks assigned to each echelon of maintenance.
- 2) Record unduly, time-consuming operations or design deficiencies prejudicial to ease of maintenance.
- 3) Where applicable, evaluate and record adequacy of organizational maintenance instructions, preventive maintenance instructions, repair and replacement instructions, and alignment instructions in the draft technical manual.

b. Operator through General Support maintenance literature (draft Technical Manual). Verify that assigned checks or tests can be performed by the operator or crew using only the equipment that will be available to the using

unit, and that each check or test can be uniformly interpreted by different test personnel.

c. Repair parts.

- 1) Compare the maintenance allocation chart and the repair parts and special tools list to determine the adequacy of repair parts support at organizational and direct as well as general support level.
- 2) Record difficulties experienced in the replacement of parts and components, and malfunctions resulting therefrom.
- 3) Record the time required to replace repair parts and components.

d. Tools and Test equipment. Evaluate the tools and test equipment contained in the basic issue items list (BIIL) for performance in their assigned echelon of maintenance. Record instances where, in the opinion of test personnel, a common tool could be substituted for a special tool, or a portion of the test item could be redesigned to accommodate a common tool.

e. Personnel skill requirements. Record MOS of test personnel indigenous to each echelon of service maintenance; record MOS of test personnel required at each echelon of service maintenance to efficiently complete task assigned to the respective maintenance facility by the maintenance allocation chart.

f. Maintainability and Reliability. Verify that the maintenance, maintainability, and reliability characteristics described in the QMR or SDR are met in completing this service test; record any deviations. Develop a maintenance history of the test item to include all specific corrective and preventive maintenance performed, manhours required, parts used, and cost incurred. Record the reliability characteristics and appropriate data as required by MTP 9-3-503.

g. Availability. Comment upon the availability and adequacy of the requirements and support items listed below:

- 1) End item with accessories, test equipment, and special tools.
- 2) Organizational common tools.
- 3) Repair parts required for service test.
- 4) Draft technical manuals.
- 5) Tactical and logistical doctrine pertaining to the unit to which the equipment will be assigned.
- 6) Appropriate equipment operators and organization, direct, and general support maintenance personnel.

6.2.5 Safety

- NOTE:
1. Safety confirmation shall comply with the requirements of USATECOM Regulation 385-6.
 2. The test fluids used are POL's and as such are hazardous, flammable, and combustible. Any other hazards will be reported to the testing officer where a decision will be made as to the continuation of testing.

Throughout the conduct of all tests, the safety characteristics of the

test item shall be observed in order to determine whether or not the test item is safe for its intended use. Toward this objective, the following principal points shall be stressed:

a. Accident prevention principles and techniques shall be integrated into the design of service tests in accordance with the provisions of USATECOM Regulation 385-6, the draft technical manual and the Safety Release.

b. Performance tests and evaluations shall be designed and conducted to the extent that sufficient test data is accumulated to determine to what degree the test item complies with the specific safety requirements of the QMR or other governing documents. Recorded safety test data will be in accordance with USATECOM Regulation 385-6 in regard to "Safety Confirmation" statements or recommendations.

c. During the conduct of all tests and inspections, test personnel will perform the applicable portions of MTP 10-3-507 and record evidence of the following:

- 1) Non-operational safety features.
- 2) Inadequate warning plates or notices.
- 3) Inadequate safety features.
- 4) Opinions regarding the suitability of the test item from a safety viewpoint.
- 5) Recommendations to improve the safety characteristics of the test item either in design or from a procedural usage point of view.

6.2.6 Human Factors Evaluation

Throughout the test, evaluate the effectiveness and characteristics of the man-item interaction as related to human factors by performing the applicable sections of MTP 10-3-505, and the following:

NOTE: In some instances the HEDGE test functions and subtests may be under consideration during the conduct of other tests. Where this condition exists, the HEDGE requirements will be integrated into and conducted simultaneously with the corresponding tests.

a. Prepare checklists to evaluate the human factors characteristic using Human Factors Evaluation Data for General Equipment (HEDGE) for the Class III A test functions, including the following:

- 1) Operability:
 - a) Stow/unstow:
 - (1) Remove/replace in stowage
 - (2) Remove/replace in case
 - b) Prepare for use:

- (1) Assemble/disassemble
- (2) Add expendables

c) Perform maintenance:

Repair of service materiel

2) Maintainability:

- a) Perform preventive maintenance
- b) Detect malfunction and isolate and identify cause
- c) Remove defective component and replace or repair

3) Transportability:

- a) Prepare for transport
- b) Load/unload
- c) Secure/unfasten

- 4) Record any inadequacies of test item design affecting ease of operation, maintenance, and transportability.
- 5) Record any recommendations to improve man-item effectiveness.

b. Evaluation of the tasks of subparagraph a, above, will include, but not be limited to the following:

- 1) Title of task conducted
- 2) Adequacy of instructions and tools to perform task
- 3) Mental and physical effort required
- 4) Design of the test item as it affects the task
- 5) Time and personnel required for task

c. A noise analysis will be made according to HEL Standard S-1-63 if deemed necessary by test personnel from on-site subjective evaluation.

6.2.7 Value Analysis

During the conduct of all tests, service personnel shall rate the test item from a value standpoint and shall record comments concerning any features of the test item which can be eliminated and/or cost reduced without degrading the test item in performance and safety. The applicable portions of USATECOM Regulation 700-1 shall be used as a basis for this evaluation.

a. Examine the test item in the following cost reduction areas:

- 1) Deletion of ineffective or unnecessary features or components.
- 2) Substitution of less expensive but comparable component or material.
- 3) Changes in the design to reduce the cost of manufacturing.

b. Examine all proposals to determine that the performance, strength,

and safety characteristics have not been lowered.

c. Record the following for each suggested change:

- 1) Component or feature involved
- 2) Suggested change
- 3) Reasons for the suggestion

6.2.8 Quality Assurance

Determine the quality of the test item as described in the applicable section of MTP 10-3-511.

6.3 TEST DATA

NOTE: In Compiling the Test Data section, test personnel should expound upon those data procedures which are other than quantitative in nature by recording narrative descriptions which will provide full details of conditions and/or events occurring during the conduct of the test.

6.3.1 Preparation for Test

6.3.1.1 Initial Inspection

6.3.1.1.1 Shipping and Packaging Inspection -

Record the following:

- a. Any noncompliance with the standards for shipping, marking, preservation and packaging.
- b. Evidence of damage; identification markings and list of printed matter enclosed.
- c. Equipment, time, and personnel required to unpack and assemble the test item in preparation for normal operation. Comments concerning the method and materials used in packing, clarity of assemblage instructions, and ease of assemblage.

6.3.1.1.2 Test Item Inspection -

Record the following:

- a. Noncompliance with marking requirements of MIL-STD-130.
- b. Evidence of defects in the manufacturing, materials and workmanship; or nonconformance with referenced standards.
- c. Evidence of certification that the test item to be evaluated meets the minimum requirements for hydrostatic testing.
- d. Evidence of improper surface finish and noncompliance with finishing treatment of MIL-T-704 when required.
- e. Evidence of improper or defective welding.
- f. Evidence of improper gasket material or faulty assembly.

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g. Improper selection of hardware, incomplete assemblies, loose and/or missing hardware.

h. Instances where direction of fluid flow is not indicated on test item housing or body.

6.3.1.2 Inventory Check

List any materials missing from the Basic Issue Item List (BIIL).

6.3.1.3 Physical Characteristics

Record the data required by MTP 10-3-500.

6.3.1.4 Operator Training and Familiarization

Record the data required by MTP 10-3-501.

6.3.1.5 Pre-operational Checks

Record the following:

a. Depreservation procedures utilized. Time required and difficulty in making test item operational.

b. Any components malfunctioning, missing, or incorrectly installed or aligned.

c. Improperly designed or functioning hardware or fasteners.

d. Any leakage of POL under operating pressure and flow.

6.3.2 Test Conduct

6.3.2.1 Operational Performance

Record the following:

a. Identification of mission, e.g. marine terminal, etc., as applicable.

b. Identification of test fluid by name, grade.

6.3.2.2 Environmental Tests

6.3.2.2.1 General

Record the following:

a. Specific effluent sampling data.

1) Total water content (free and dissolved) expressed in parts per million (PPM).

2) Total solids in milligrams per liter.

3) Interfacial surface tension value.

4) Water separometer index.

- 5) Specific gravity.
- 6) Viscosity.
- b. Test fluid flow in gpm.
- c. Test item differential pressure to psi.
- d. Test fluid temperature in °F.
- e. Meteorological conditions.
- f. Evidence that the test items capability to maintain cleaning performance is degraded when subjected to the following fuels:
 - 1) Gasoline
 - 2) Kerosene
 - 3) Oil
 - 4) Fluid lubricants if applicable
- g. Evidence that the test item is difficult to install and remove from the pipeline installation.
- h. Evidence of adverse effects of operation during transfer or storage of POL, under static and dynamic flow conditions.
 - 1) Degradation of water removal in parts per million of water content and a function of operation time in hours.
 - 2) Increase of pipeline pressure in psi for operation time in hours.
 - 3) Reduction at pipeline flow or delivery in gpm or an increase in pump motor speed (rpm) or power (brake horsepower) to maintain the desired flow.
 - 4) Excessive pressure drop across the test item in psi for the number of operation hours.

6.3.2.2.2 Hot-Dry Climatic Conditions Test

Record the following:

- a. Overall effect of desert conditions on test item performance.
- b. Overall effect of desert conditions on test item compatibility.
- c. Any noted test item characteristics or malfunctions which occurred as a direct result of desert usage.
- d. Operational performance data resulting from re-test of 6.2.1.

6.3.2.2.3 Warm-Wet Climatic Conditions Test

Record the following:

- a. Overall effect of tropic conditions on test item performance.
- b. Overall effect of tropic conditions on test item compatibility.
- c. Any noted test item characteristics or malfunctions which occurred as a direct result of tropic usage.
- d. Operational performance data resulting from re-test of 6.2.1.

6.3.2.2.4 Cold Climatic Conditions Test

Record the following:

- a. Overall effect of arctic conditions on test item performance.
- b. Overall effect of arctic conditions on test item compatibility.
- c. Any noted test item characteristics or malfunctions which occurred as a direct result of arctic usage.
- d. Operational performance data resulting from re-test of 6.2.1.

6.3.3 Transportability

Record the following:

- a. Data required by MTP 10-3-503.
- b. For each phase of the test:
 - 1) Procedures, materials and tools utilized.
 - 2) Time required.
 - 3) Personnel required.
 - 4) Adequacy of instructions.
 - 5) Difficulties experienced and changes recommended to reduce effort required for any task.

6.3.3.1 Preparation for Transport

Record the following:

- a. Disassembly, unlocking and removal operations performed on test item; difficulty in accomplishing procedures; suggestions for simplifying procedures.
- b. Comments on effectiveness of tools and equipment provided for packaging and transport mounting the test item.
- c. Evaluate tie down devices and lifting attachments for their effectiveness through location, number, accessibility, etc. in accordance with MIL-STD-209.

6.3.3.2 Load/Unload

List comments regarding the effectiveness of the material handling equipment and procedures utilized in moving the packaged test item to and into/onto the carrier.

6.3.3.3 Transporting Modes

Record the following:

- a. The data required by MTP 10-3-503.
- b. The data required by MTP 7-3-516.
- c. The data required by MTP 10-3-510.
- d. Any damage to or other undesirable effects observed on container, mounting, or test item following each subtest.

6.3.4 Maintenance Evaluation

Record the data required by MTP 10-3-504 including the following specific items.

- a. Inadequate, incomplete or missing maintenance allocation chart.
- b. Difficult or time consuming maintenance operations.
- c. Inadequate, incomplete, or missing maintenance instructions.
- d. Inability of operator or test item users to complete tasks assigned them by the maintenance allocation chart.
- e. Missing or inadequate repair parts. Incidences of parts assigned to the wrong maintenance facility.
- f. Time required to replace or repair each malfunctioning part.
- g. Adequacy of tools and test equipment to perform tasks assigned to the respective maintenance facility.
- h. Instances where a common tool could be substituted for a special tool, or where the test item could be modified without loss of function to accommodate a common tool.
- i. Compare MOS rating of personnel indigenous to each echelon of maintenance with that required in the maintenance allocation chart; list any deviations.
- j. Record deviations of test item maintainability and reliability characteristics specified in the QMR with those developed and recorded by completing this service test.
- k. Record pertinent comments on the availability of test item and its support items.

6.3.5 Safety

Record data required by MTP 10-3-507 and the following:

- a. List any inadequate warning plates or notices.
- b. List any inadequate safety features.
- c. List any opinions regarding the suitability of the test item from a safety viewpoint.
- d. List any recommendations to improve the safety characteristics of the test item either in design or from a procedural-usage point of view.

6.3.6 Human Factors Evaluation

Record the data required by MTP 10-3-505 and in addition complete the checklists prepared for the HEDGE test function tasks of the operability, maintainability, and transportability subtests. Rate each task as satisfactory or unsatisfactory from a human factors standpoint. In rating each task consider and record instances of the following:

- a. Instructions.
 - 1) Lacking clarity
 - 2) Insufficient or excessive detail

b. Tools.

- 1) Proper tools not supplied
- 2) Excess of special tools required
- 3) Additional tools recommended

c. Mental and Physical Effort.

- 1) Above average skill or strength required of test personnel
- 2) Task is excessively tiring

d. Test Item Design.

- 1) Poor location of component
- 2) Component not accessible

e. Time required for task is excessive and reasons why.

f. Personnel requirements to operate and maintain test item.

g. Record qualitative comments as to whether or not the sound level of the test item is annoying, not annoying, etc., and other noise evaluation results.

6.3.7 Value Analysis

For each feature or component of the test item being considered for cost reduction, record the following:

- a. Description of the feature/component
- b. Recommended change(s) to be made
- c. Reason(s) for recommendations

6.3.8 Quality Assurance

Record data collected as described in the applicable section of MTP 10-3-511.

6.4 DATA REDUCTION AND PRESENTATION

All data will be summarized using tabulations and/or charts as appropriate. Where photographs are used, they will be positively identified. The data will be analyzed to determine to what degree the test item and its maintenance package meet the requirements of QMR's, SDR's and detailed military specifications of the test item. Provide a recommendation as to the suitability of the test item and the maintenance package for use by the Army.

A Safety Confirmation, based on the data of paragraph 6.3.5 shall be presented in accordance with USATECOM Regulation 385-6.

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13. ABSTRACT This Army Service Test Procedure describes test methods and techniques for evaluating the performance and characteristics of Pipeline (Petroleum, Oils and Lubricants) Cleaning Equipment, and for determining their suitability for service use by the U.S. Army. The evaluation is related to criteria expressed in applicable Qualitative/Materiel Requirements (QMR), Small Development Requirements (SDR), Technical Characteristics (TC), or other appropriate design requirements and specifications.			

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